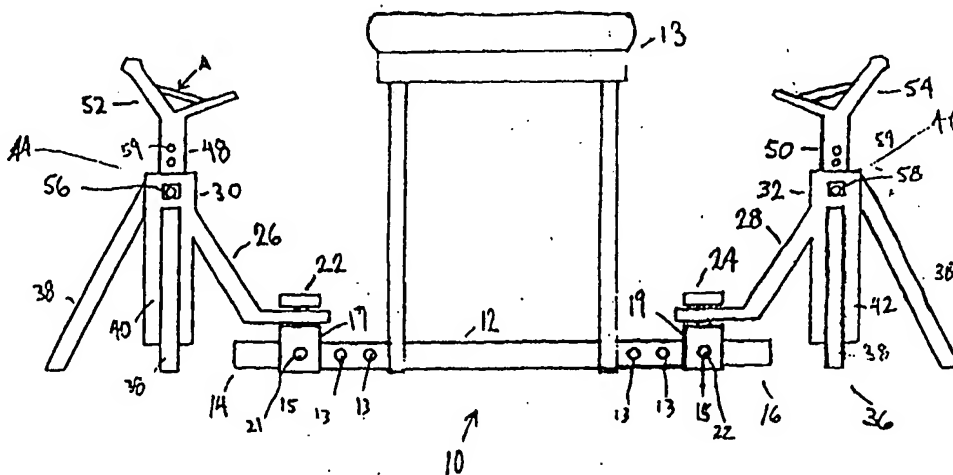




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(54) Title: ADJUSTABLE DUMBBELL SUPPORT ASSEMBLY



(57) Abstract

A dumbbell support assembly (10) has a laterally extending base member (12) having attached at each end a pivoting strut base (30, 32). Each pivoting strut base has a vertical strut (48, 50) with a dumbbell support (52, 54) adapted to support a dumbbell (63) thereon. Each dumbbell support can be rotatably about an axis defined by the strut (Fig. 3). The assembly can be positioned anywhere along the length of the chair or bench (13) in a desired position. The struts (48, 50) have a vertical height adjustment feature (58, 59) enabling each dumbbell holder to be adjusted in height, independently of the other. The angle of each dumbbell relative to a vertical axis (22, 24) can be selected, independently. The optional rotating adjustment of the dumbbell holder (Fig. 3) allows the user to precisely angle each dumbbell, independently of the other.

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ADJUSTABLE DUMBBELL SUPPORT ASSEMBLY

BACKGROUND OF THE INVENTION

The present invention relates generally to weightlifting exercise equipment and, more particularly, to an adjustable dumbbell support assembly for safely and conveniently adjusting dumbbell supports to desired positions for use in exercising with
5 dumbbells.

Many individuals who train with weights prefer to use free weights for, among other reasons, the unlimited variety of unrestricted positioning during exercise motions that free weights permit. Dumbbells, as compared to barbells, enable the utmost freedom of positioning in that, when gripped by one hand, they can be moved linearly and rotated
10 angularly during movement to virtually any position that is attainable by the body of the user. Such freedom of movement provides the broadest capability for variety in exercises and enables users to very precisely target muscle areas to be worked. One of the main limitations in using dumbbells is the requirement to start with the dumbbells resting on the floor or on a dumbbell support device of the type generally known.

15 Depending on what exercise a user is currently performing, the size of the user, and the amount of weight he or she is using - the desired start and finish positions for the dumbbells could vary. Current generally known dumbbell supports do not accommodate a variety of resting positions. Typically, a user has to choose between starting with the dumbbells on the floor, or on a modified standard bench press rack equipped with
20 dumbbell holding devices. Often, neither provides a desirable starting position. In either situation, dumbbell users have to forego certain exercises, use less weight than is

desirable, perform less repetitions than is desirable, or subject themselves to danger when working out.

In the treatment of injured or physically disabled people there is a need for a wide range of adjustability in all exercise equipment to accommodate specific physical
5 conditions and precisely prescribed exercises. In certain situations such as, for example, where a rehabilitating patient may not be able to reach the ground or to reach from a fixed-position bench press-type support strut to pick up dumbbells for an exercise, the patient will require an attendant therapist or will be unable to perform the exercise.

Known apparatus designed specifically for dumbbell use provide little, of any,
10 solution to the problem. Certain known devices provide adapter heads shaped to hold dumbbells and adapted to extend from the vertical struts on a standard weight bench. These devices provide, at most, only one degree of adjustability in the vertical direction. None of the know apparatus facilitate linear adjustability in three dimensions or angular adjustability. Other known apparatus require the user to purchase and use an entire bench
15 or station rather than a simple device or assembly that has the versatility to be used conveniently with a virtually unlimited variety of benches and chairs, or with neither.

SUMMARY AND OBJECTS OF THE INVENTION

The present invention comprises a dumbbell support assembly that is simple in
20 construction, structurally sound and balanced, durable, adjustable angularly and in multiple planes, and versatile.

The assembly of the present invention generally comprises a laterally extending base member having attached at each end a pivoting strut base. As an option, the laterally

extending base member can be adjustable in length. Each pivoting strut base has extending therefrom a generally vertical strut that is adjustable in length. Each strut accommodates a dumbbell holder that, optionally, can be rotatable about an axis defined by the strut.

5 In use, the entire assembly can be used alone for exercises performed where the user is standing up. Also, the assembly can be positioned to pass underneath a bench or chair so that one of the strut and dumbbell holders are positioned on each side. Because the assembly is not fixed to the chair or bench, it can be positioned anywhere along the length of the chair or bench in a desired position. The vertical height adjustment feature
10 of the struts enable each dumbbell holder to be height adjusted, independently of the other. The pivoting feature of each strut base enable each to be pivoted independently so that the position of each dumbbell holder in a plane parallel to the floor can be adjusted without moving the assembly, and so that the angle of each dumbbell relative to a vertical axis can be selected, independently. The optional rotating adjustment of the dumbbell
15 holder allows the user to precisely angle each dumbbell, independently of the other.

The present invention assembly addresses the problems inherent to the known devices described above and achieves other objectives that are apparent in the specification and claims below.

20

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a front view of a first embodiment of the present invention apparatus.

FIG. 2 is a front view of a second embodiment of the present invention apparatus.

FIG. 3 is a top view of a component that is common to the first and second embodiments.

FIG. 4 is a side view of a component that is common the first and second embodiments.

5 FIG. 5 is a top view of the apparatus of FIG. 2, where the apparatus is in a first mode.

FIG. 6 is a partial top view of the apparatus of FIG. 2, where the apparatus is in another mode.

10 FIG. 7 is a front view of the apparatus of FIG. 1 shown positioned underneath a weightlifting bench.

FIG. 8 is a top view of the apparatus of Fig.2 shown positioned underneath a weightlifting bench.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

15 A first embodiment of the present invention adjustable dumbbell support assembly (10) is shown in FIG.1. The assembly (10) comprises a base (12), preferably in the shape of an elongated member, having a length providing at least enough distance for a person to stand between the first end (14) and the second end (16), or for a standard weightlifting bench (13) to be positioned between the first and second ends (14, 16).

20 At the first and second ends (14, 16) of the base (12) there are first and second pivot pins (22, 24), respectively. The pivot pins (22, 24) are adapted to pivotally attach a pivot support bracket (26, 28) corresponding to one of first and second support struts (30, 32) to a respective end (14, 16) of the base (12). Each pivot support bracket (26, 28) is

joined to a respective support strut (30, 32). Each support strut (30, 32) has a base (34, 36). Each base (34, 36) may be of various known configurations, including flat surfaces (35, 37) as shown in FIG.2 or, as shown in FIG.1, a series of angled support legs (38). Each support strut (30, 32) has a vertically extending body portion (40, 42) and a top end (44, 46). Each body portion (40, 42) may comprise a rectangular (as shown), circular or other desirable cross-sectional shape. Each body portion (40, 42) is adapted to telescopically receive a vertical rod (48, 50) from each of a set of first and second dumbbell holders (52, 54). In the embodiment shown in FIG. 2, horizontally aligned support brackets (27, 29) are provided.

Each vertical rod (48, 50) is linearly movable within the corresponding body portion (40, 42) so that the height of each dumbbell holder (52, 54) can be selectively adjusted. Adjustment means can take on the form of one of known conventional types such as a push/pull pin (56, 58) that engages a selected one of a series of longitudinally spaced holes (59) on the rod (48, 50) in order to set a desired height. Instead of a series of holes, a series of circular grooves (61) as shown in FIG. 3, can be used to set the height of the dumbbell holder (52, 54) while enabling free rotational adjustment of the dumbbell holder (52, 54) about a longitudinal vertical axis extending from the top to the bottom of the body portion (40, 42). The dumbbell holders can be rotationally adjusted about the vertical axis to a desired angular position. While the rod (48, 50) and dumbbell holder (52, 54) can take on one of a variety of known shapes, in the preferred embodiment the rod is bifurcated at the top (49) generally forming a "Y-shape" in order to allow clearance for the user's hand and wrist while grasping a dumbbell (63) that is seated in the dumbbell holder (52, 54), as shown in FIG. 4.

To accommodate width adjustments for a user's preference, the base (12) is provided with a plurality of holes (13) adapted to receive a respective pin (15) or similar means to fix a slideable block (17, 19) corresponding to each support strut (30, 32) to the base (12). Each block (17, 19) has a pin hole (21, 23) to accommodate each pin (15).

- 5 The blocks (17, 19) each have an opening to accommodate the base (12) slidably positioned therethrough. When each block (17, 19) is slidably adjusted relative to the base (12), a pin (15) is inserted through the respective pin hole (21, 23) which is aligned with a selected one of the holes (13) in the base (12).

- The dumbbell holders attached at the top of the rods (48, 50) can take on one of a
10 variety of available designs or the preferred embodiment of the present invention.

- Referring to the dumbbell holder (52) of the preferred embodiment illustrated in the side view shown in FIG. 5, there is shown a base (60) and a top section (62). The base (60) and top section (62) are generally flat plates connected via a central connector (65, FIG. 4) attached to the top section (62) and joining left and right sides thereof. In FIG. 6,
15 there is a partial, plan view of only the base (60), showing a cut-away portion (64) in the center for enabling a user's hand and wrist to clear the front edge (66) of the base (60) in order to grasp a dumbbell (not shown) being held in the holder (52). The base (60) is, preferably, tilted back slightly from level to prevent forward rolling of a round dumbbell or to accommodate an octagonal dumbbell. The width of the base (60) should be
20 sufficient to provide excess clearance for most size dumbbells. The angle of tilt is preferably somewhere in the range from slightly greater than zero degrees measured at horizontal to - moving counterclockwise in FIG. 5 - less than ninety degrees to prevent the dumbbell (63) from rolling or sliding forward and falling out of the holder (54). It is

desirable to make the length of the top rear portion (62) greater than the diameters of most dumbbells to ensure prevention of rearward falling.

The various components of the preferred embodiment should be, but are not limited to, tubular steel members for maximum strength and efficiency in manufacture and cost. It is recognized that such things as various cross-sectional geometry, thickness,
5 and specific shapes of various components of the present invention may vary without departing from the scope of invention claimed herein.

In use, the present invention assembly provides dumbbell holders and a common support assembly that can be adjusted to accommodate a variety of desirable positions to initiate and finish exercises. The present invention assembly can be used alone, such as
10 for a standing user, or with a chair, bench (13) as shown in FIG.s 1 and 7A- 7B or other apparatus, simply by positioning the assembly as desired. In addition to the degrees of adjustability described specifically above, the assembly allows inherent adjustability in that it does not need to be structurally fixed to a chair, bench or the like and, thus, can be
15 precisely located as desired.

A second embodiment is presented in FIG.s 8-10. According to FIG.8, there is a unitary base (212) comprising a generally elongated member having holes (214, 216), each in generally symmetrical spaced relation for the purpose of engaging a structure, such as an elongated member (218, 219) on a modified bench (213) as shown in FIG. 9.
20 The base (212) also has, as an option, a pair of generally symmetrically spaced hinges (220, 222). Attached at the ends of the base (212) are base and strut assemblies (234, 236) of the type described with respect to the first embodiment and having dumbbell

holders thereon of the type described with respect to the first embodiment. The hinges (220, 222) allow the assemblies (234, 236) to be selectively pivoted thereabout.

As shown in FIG.9, a modified bench (213) has a pair of generally elongated members (218, 219), one on each side. The other is identical. In order to enable the holes (214, 216) to fit over the members (218, 219), each member (218, 219) may be provided with a hinge (228) and clasp (230) to enable the member (218, 219) to pivot about the hinge (228) when the clasp (230) is opened. This allows the holes (214, 216) to be threaded over the members (218, 219) when the base (212) is placed under the bench (213) as shown in FIG. 10. The clasp (230) is then reattached or closed. The base (212) is then slideable over the members (226) so that the dumbbell holder assemblies (234, 236) are adjustable with respect to positioning between the head or foot of the bench (213) as shown in FIG. 10. Angular and width adjustments can be made by rotating the assemblies (234, 236) with respect to the hinges (220, 222). Such width adjustments vary the effective length of the base (212).

A third embodiment is presented in FIG.s 11-12. As shown in the cross-sectional view of FIG. 11A, certain conventional weight-training benches (313) comprise an I-beam type base having at each end a footing (315) and a column section (316). A pad (317) is supported therebetween. The bench (313) is shown in FIG. 11B with the pad (317) removed to more clearly illustrate the base structure. The column sections (316) are connected by a single cross member (318). The third embodiment of the present invention is shown in FIG. 12, having a base (312) with a single opening (314), preferably centered, adapted to slidingly fit over the cross member (318). The remaining features of the third embodiment are similar to those of the embodiment illustrated in

FIG. 8 and discussed above. As in the embodiment of FIG. 8, the present invention embodiment of FIG. 12 can be selectively slid along a direction aligning the head and foot of the bench to adjustably position the dumbbell supports as desired for engaging in a variety of exercises.

5 While the foregoing description has described the preferred embodiments, it is recognized that the scope of the claimed invention is not limited to the specific dimension, materials and geometry discussed in the Specification, but that it encompasses variations that include the limitations as broadly set forth in the claims.

I CLAIM:

1) A dumbbell support assembly comprising:

a generally elongated base lying in a first plane, said base having first and second ends;

5 a first vertical strut and a second vertical strut, each extending in a vertical direction generally perpendicular to said first plane and each attached at a respective one of said first and said second ends of said base;

a first dumbbell holder and a second dumbbell holder, each mounted to a respective one of said first and second vertical struts and adapted to receive a dumbbell therein;

10 whereby said assembly of said base, said struts and said holders is free-standing.

2. An assembly according to claim 1, wherein

said first and second vertical struts are spaced apart sufficiently, and the vertical height of said base is low enough, for a chair or bench to be selectively placed over said base and in-between said first and second vertical struts so that
5 said chair or said bench can be utilized by a user for exercising with said dumbbells.

3. An assembly according to claim 1, further comprising

base-length adjusting means for selectively adjusting the length of said base within said first plane.

4. An assembly according to claim 3, wherein

said base-length adjusting means comprise elongated extension members telescopingly received in said first and said second ends of said base.

5. An assembly according to claim 1, further comprising

dumbbell holder height adjustment means for selectively adjusting the vertical height of each of said dumbbell holders relative to said first and second vertical struts, respectively.

6. An assembly according to claim 5, wherein

said dumbbell holder height adjustment means comprise an extension rod extending from each of said first and second dumbbell holders;

said extension rods being telescopingly received, respectively, in said first and said second vertical struts and being adapted to be positioned therein at various vertical positions.

7. An assembly according to claim 1, further comprising

dumbbell holder angular adjustment means for selectively adjusting the angular orientation of each of said dumbbell holders, respectively, about a vertical axis generally corresponding to a central vertical axis of each of said first and second vertical struts.

8. An assembly according to claim 7, wherein

said dumbbell holder angular adjustment means comprise an extension rod
extending from each of said first and second dumbbell holders;

said extension rods being attached to a respective one of said vertical
5 struts and being rotatable relative to said respective strut.

9. An assembly according to claim 1, further comprising

vertical strut pivot means for selectively pivoting each of said first and
said second vertical struts about a respective axis located at said first and second
ends of said base.

10. An assembly according to claim 9, wherein

said vertical strut pivot means comprise a pivot attachment arm extending
from each of said first and said second vertical struts, whereby each said pivot
attachment arm is pivotally attached to a respective one of said first or said second
5 ends of said base.

11. An assembly according to claim 10, wherein

each said pivot attachment arm is pivotally attached to said base by a pin
which defines each respective axis about which said first or said second vertical
strut pivots.

12. An assembly according to claim 1, wherein

each said dumbbell holder comprises a dumbbell supporting surface having a central opening such that a user's hand or wrist can pass therethrough in an unobstructed manner to grasp a dumbbell held within said dumbbell holder.

13. An assembly according to claim 12, wherein

each said dumbbell holder further comprises a front wall and a rear wall attached, respectively, to front and rear edges of said dumbbell supporting surface and adapted to prevent a dumbbell held on said dumbbell supporting surface from inadvertently rolling or sliding off of said dumbbell supporting surface.

14. An assembly according to claim 13, wherein

said front and rear walls of each said dumbbell holder are positioned at respective angles to a vertical plane in order to guide movement of a dumbbell into said dumbbell holder.

15. An assembly according to claim 1, further comprising

a first strut base and a second strut base, each corresponding to one of said first and second vertical struts, and each being attached to said elongated base.

16. An assembly according to claim 15, wherein

said first and second strut bases each comprise a series of legs adapted to contact a floor surface and to support one of said first or second vertical struts.

17. A dumbbell support assembly comprising:

a generally elongated base lying in a first plane, said base having first and second ends;

5 a first vertical strut and a second vertical strut, each extending in a vertical direction generally perpendicular to said first plane and each attached at a respective one of said first and said second ends of said base, said first and second vertical struts are spaced apart sufficiently, and the vertical height of said base is low enough, for a chair or bench to be selectively placed over said base and in-between said first and second vertical struts so that said chair or said bench can be
10 utilized by a user for exercising with said dumbbells;

a first dumbbell holder and a second dumbbell holder, each mounted to a respective one of said first and second vertical struts and adapted to receive a dumbbell therein;

15 base-length adjusting means for selectively adjusting the length of said base within said first plane;

dumbbell holder height adjustment means for selectively adjusting the vertical height of each of said dumbbell holders relative to said first and second vertical struts, respectively

20 whereby said assembly of said base, said struts and said holders is free-standing.

18. An assembly according to claim 17, wherein

said base-length adjusting means comprise elongated extension members telescopingly received in said first and said second ends of said base.

19. An assembly according to claim 17, wherein

said dumbbell holder height adjustment means comprise an extension rod extending from each of said first and second dumbbell holders;

said extension rods being telescopingly received, respectively, in said first and said second vertical struts and being adapted to be positioned therein at various vertical positions.

20. An assembly according to claim 17, further comprising

dumbbell holder angular adjustment means for selectively adjusting the angular orientation of each of said dumbbell holders, respectively, about a vertical axis generally corresponding to a central vertical axis of each of said first and second vertical struts.

21. An assembly according to claim 20, wherein

said dumbbell holder angular adjustment means comprise an extension rod extending from each of said first and second dumbbell holders;

said extension rods being attached to a respective one of said vertical struts and being rotatable relative to said respective strut.

22. An assembly according to claim 17, further comprising

vertical strut pivot means for selectively pivoting each of said first and said second vertical struts about a respective axis located at said first and second ends of said base.

23. An assembly according to claim 22, wherein

said vertical strut pivot means comprise a pivot attachment arm extending from each of said first and said second vertical struts, whereby each said pivot attachment arm is pivotally attached to a respective one of said first or said second ends of said base.

24. An assembly according to claim 23, wherein

each said pivot attachment arm is pivotally attached to said base by a pin which defines each respective axis about which said first or said second vertical strut pivots.

25. An assembly according to claim 17, wherein

each said dumbbell holder comprises a dumbbell supporting surface having a central opening such that a user's hand or wrist can pass therethrough in an unobstructed manner to grasp a dumbbell held within said dumbbell holder.

26. An assembly according to claim 25, wherein

each said dumbbell holder further comprises a front wall and a rear wall attached, respectively, to front and rear edges of said dumbbell supporting surface and adapted to prevent a dumbbell held on said dumbbell supporting surface from inadvertently rolling or sliding off of said dumbbell supporting surface.

5

27. An assembly according to claim 26, wherein

said front and rear walls of each said dumbbell holder are positioned at respective angles to a vertical plane in order to guide movement of a dumbbell into said dumbbell holder.

28. An assembly according to claim 17, further comprising

a first strut base and a second strut base, each corresponding to one of said first and second vertical struts, and each being attached to said elongated base.

29. An assembly according to claim 28, wherein

said first and second strut bases each comprise a series of legs adapted to contact a floor surface and to support one of said first or second vertical struts.

30. A dumbbell support assembly comprising:

a generally elongated base lying in a first plane, said base having first and second ends, said base further having bench-engaging means for attaching to a bench;

5 a first vertical strut and a second vertical strut, each extending in a vertical direction generally perpendicular to said first plane and each attached at a respective one of said first and said second ends of said base;

 a first dumbbell holder and a second dumbbell holder, each mounted to a respective one of said first and second vertical struts and adapted to receive a
10 dumbbell therein;

 whereby said assembly of said base, said struts and said holders adjustably attaches to said bench.

31. An assembly according to claim 30, further comprising

 base-length adjusting means for selectively adjusting the length of said base within said first plane

32. An assembly according to claim 30, further comprising

 dumbbell holder height adjustment means for selectively adjusting the vertical height of each of said dumbbell holders relative to said first and second vertical struts, respectively.

32. An assembly according to claim 32, wherein

 said dumbbell holder height adjustment means comprise an extension rod extending from each of said first and second dumbbell holders;

said vertical strut pivot means comprise a pivot attachment arm extending from each of said first and said second vertical struts, whereby each said pivot attachment arm is pivotally attached to a respective one of said first or said second ends of said base.

37. An assembly according to claim 36, wherein

each said pivot attachment arm is pivotally attached to said base by a pin which defines each respective axis about which said first or said second vertical strut pivots.

38. An assembly according to claim 30, wherein

each said dumbbell holder comprises a dumbbell supporting surface having a central opening such that a user's hand or wrist can pass therethrough in an unobstructed manner to grasp a dumbbell held within said dumbbell holder.

39. An assembly according to claim 38, wherein

each said dumbbell holder further comprises a front wall and a rear wall attached, respectively, to front and rear edges of said dumbbell supporting surface and adapted to prevent a dumbbell held on said dumbbell supporting surface from inadvertently rolling or sliding off of said dumbbell supporting surface.

40. An assembly according to claim 39, wherein

said front and rear walls of each said dumbbell holder are positioned at respective angles to a vertical plane in order to guide movement of a dumbbell into said dumbbell holder.

41. An assembly according to claim 30, further comprising

a first strut base and a second strut base, each corresponding to one of said first and second vertical struts, and each being attached to said elongated base.

42. An assembly according to claim 41, wherein

said first and second strut bases each comprise a series of legs adapted to contact a floor surface and to support one of said first or second vertical struts.

43. An assembly according to claim 30, wherein

said bench-engaging means comprise at least one hole through said base.

44. An assembly according to claim 30, wherein

said bench-engaging means are adapted to slidably engage said bench so that said base can be adjustably positioned with respect to said bench.

45. An assembly according to claim 30, wherein

said bench-engaging means are adapted to slidably engage said bench so that said base can be adjustably positioned with respect to said bench in a direction generally along a longitudinal axis of said bench.

46. An assembly according to claim 43, wherein

said at least one hole has a cross-sectional size and shape that corresponds to the cross-section of a member of said bench.

47. An assembly according to claim 30, wherein

said bench-engaging means comprise a plurality of holes through said base.

48. An assembly according to claim 30, wherein

said bench-engaging means comprise a pair of holes through said base.

FIG. 1

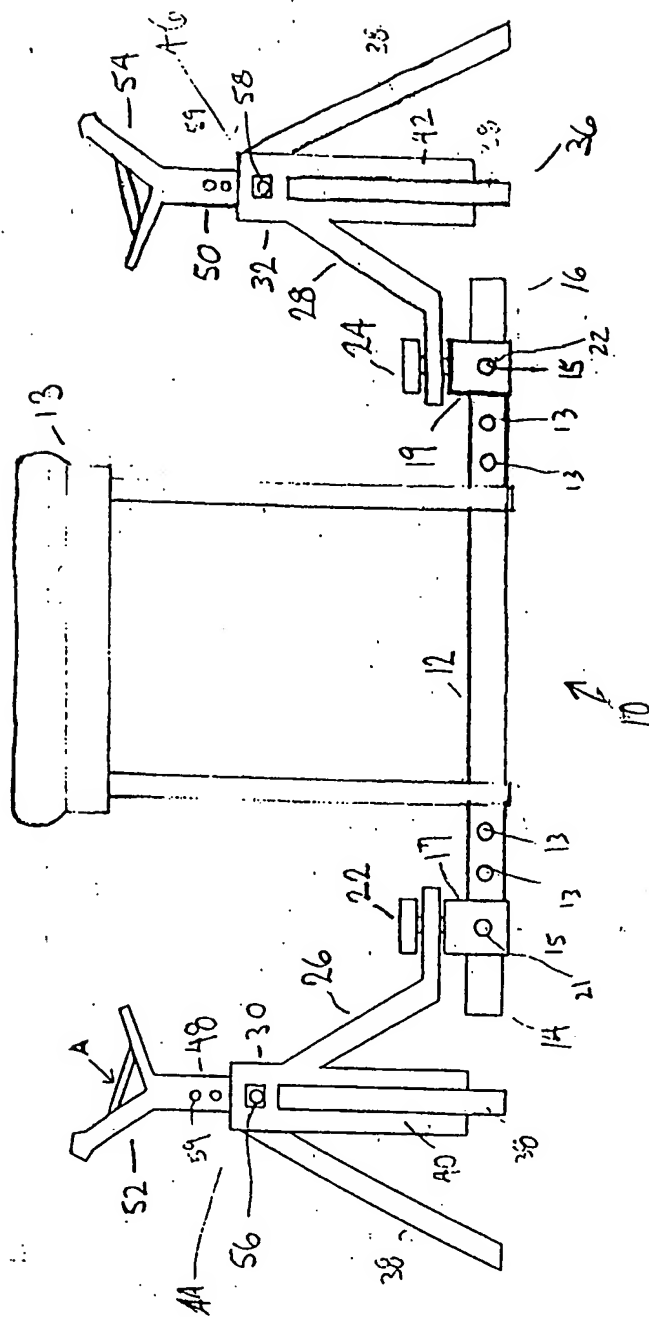


FIG. 2

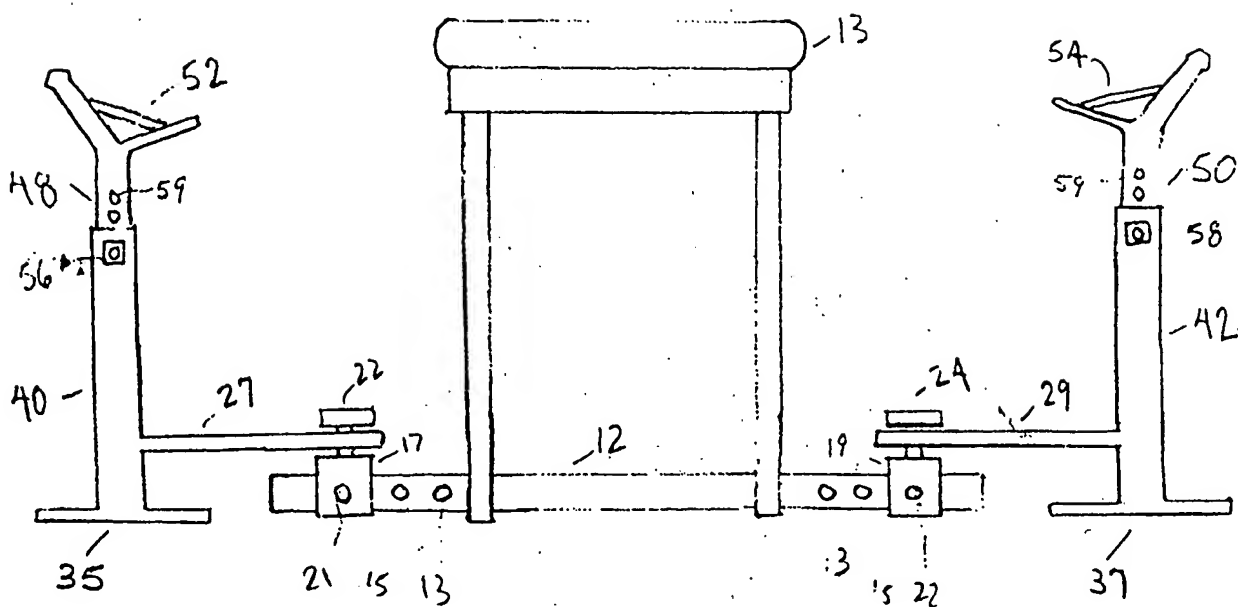


FIG. 3

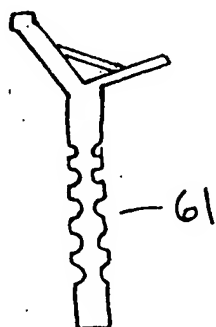


FIG. 5

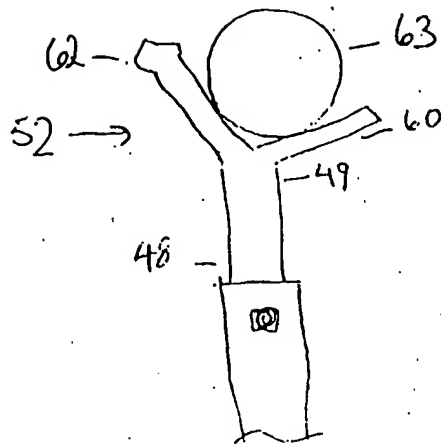


FIG. 4

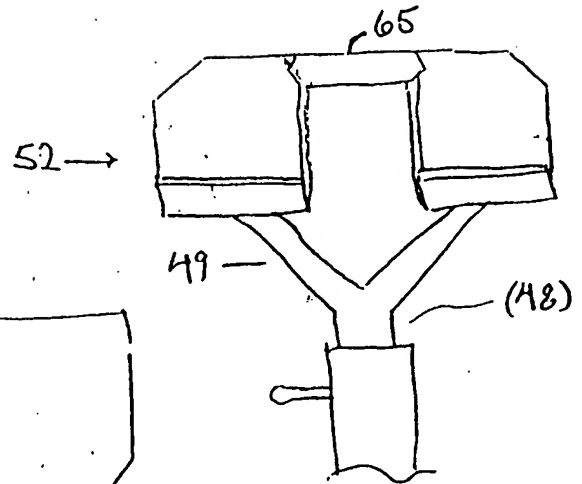


FIG. 6

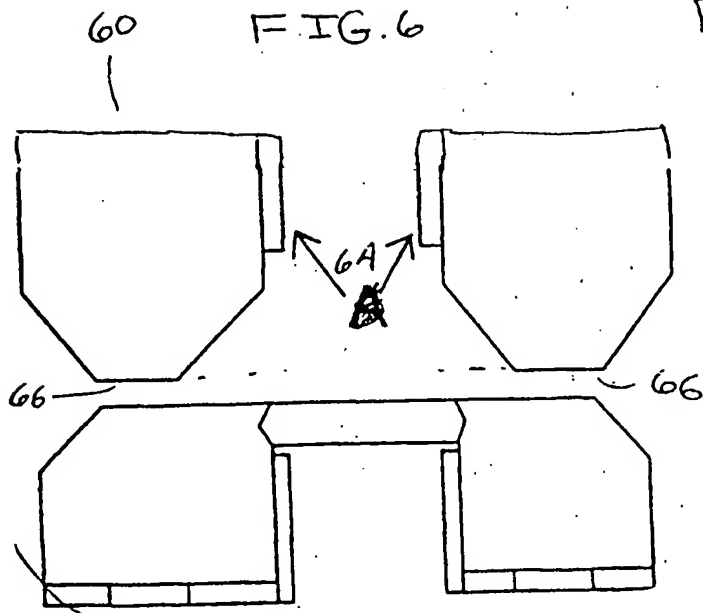


FIG. 10

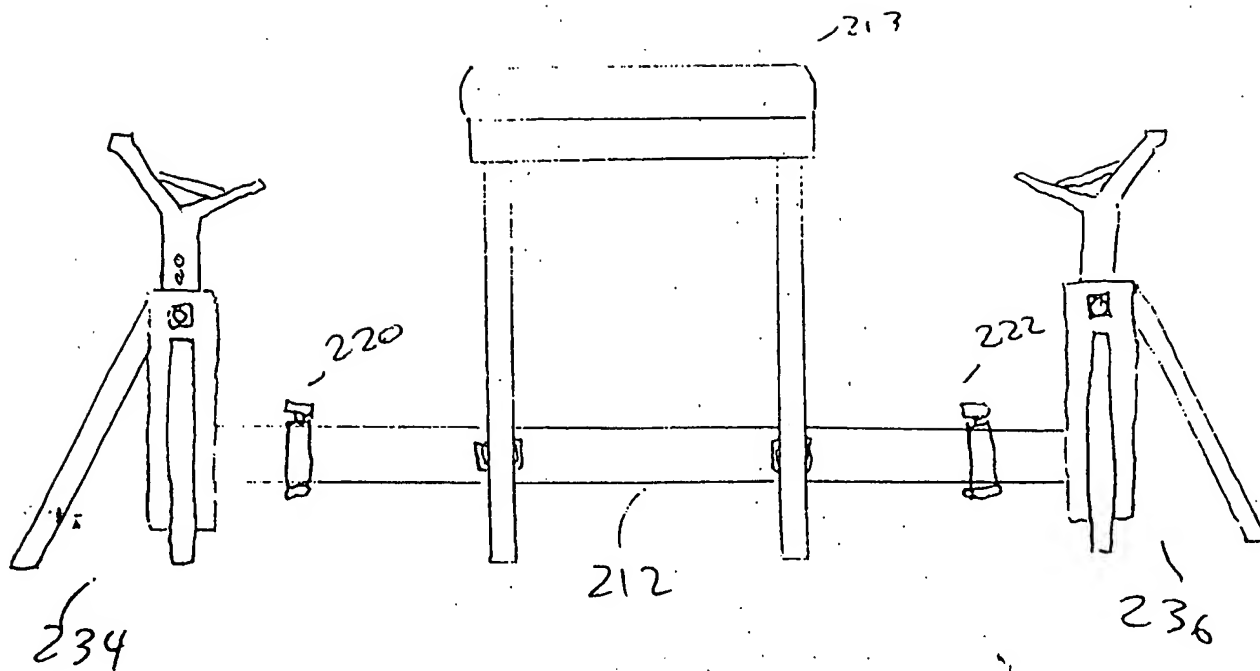
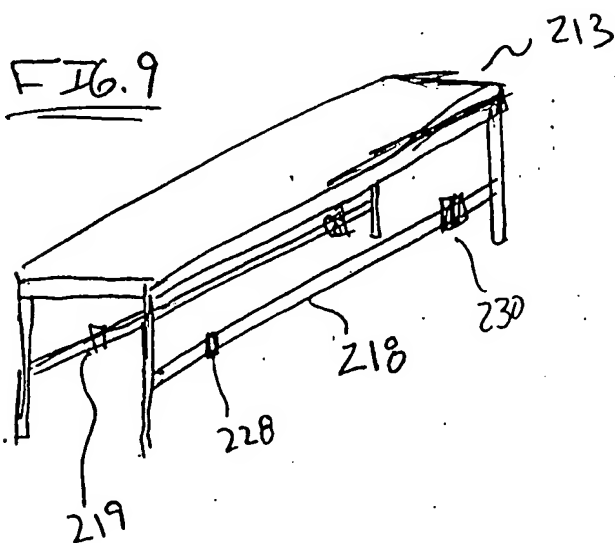


FIG. 9



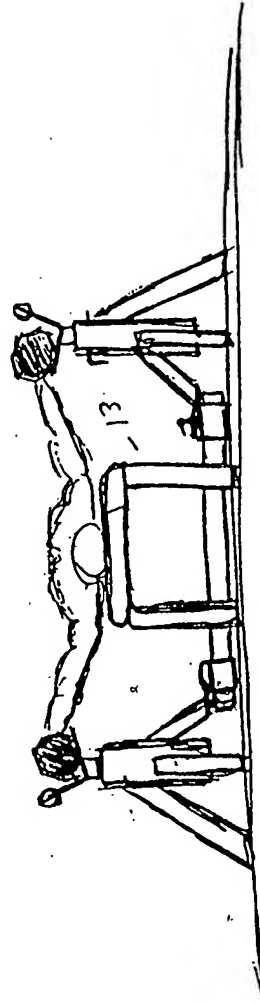
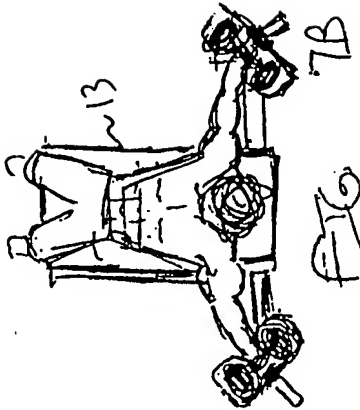


FIG 8

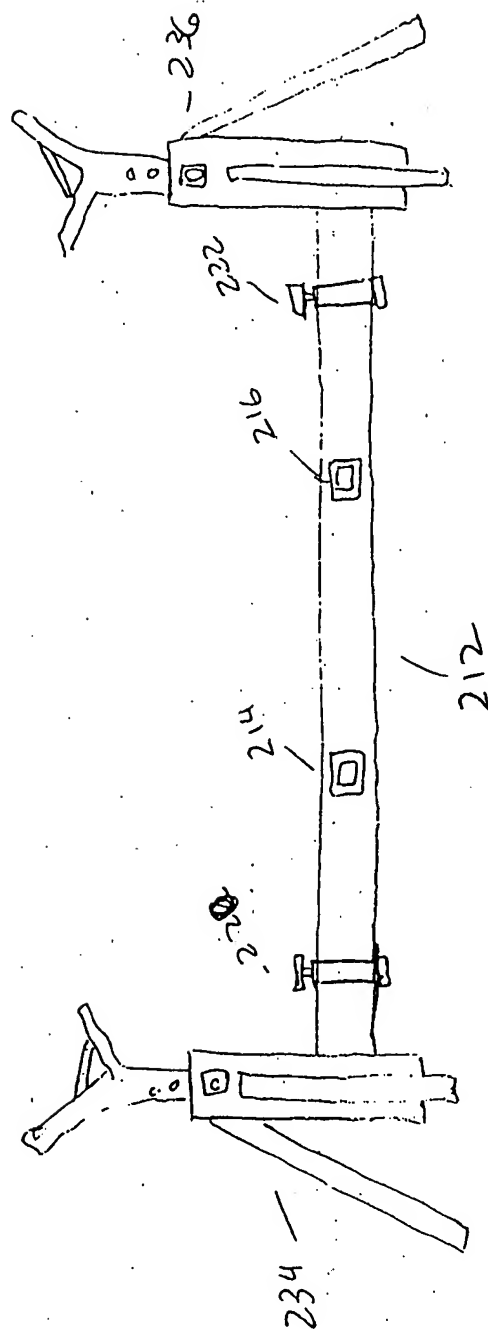


FIG. 11A

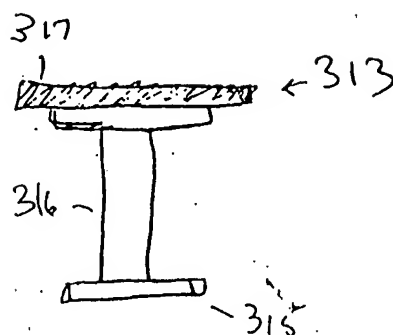


FIG. 11B

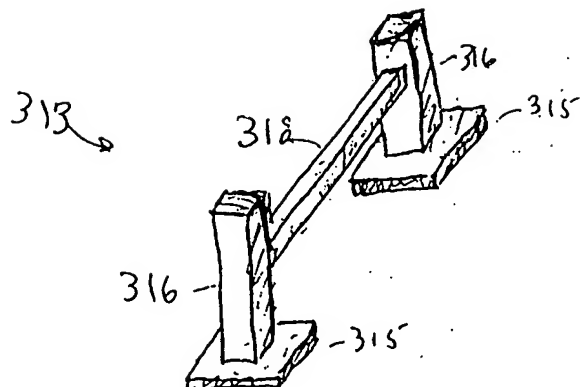
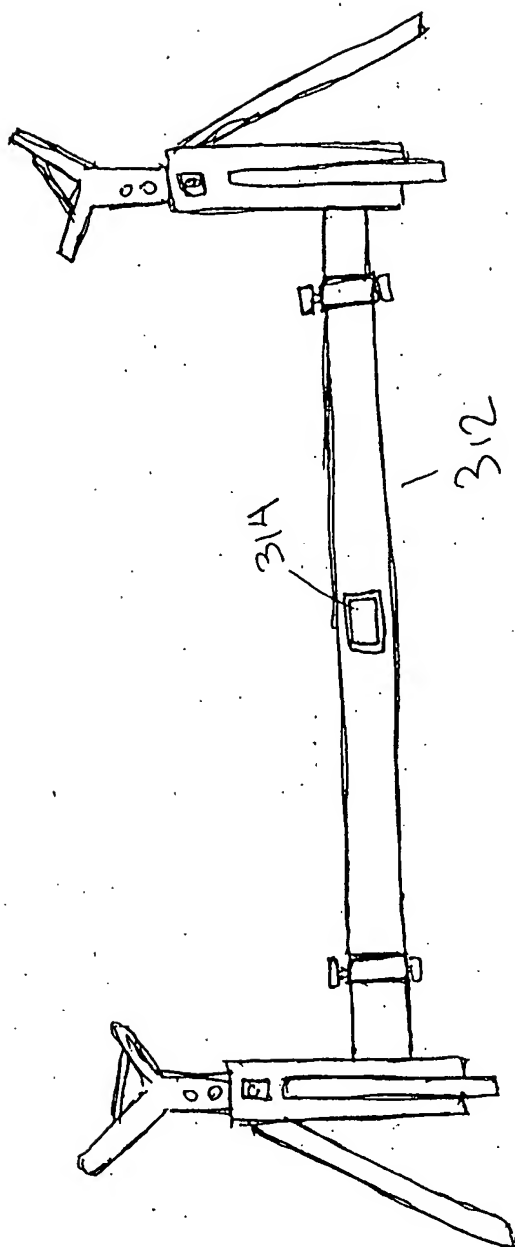


FIG. 12



INTERNATIONAL SEARCH REPORT

International application No.
PCT/US99/02482

A. CLASSIFICATION OF SUBJECT MATTER

IPC(6) : A63B 21/078

US CL : 482/104

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 482/104

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5,411,459 A (HAYDEN) 02 May 1995, col. 1 lines 33-35.	1, 5, 6, 12-15
Y		1-29
Y	GB 2 076 299 A (JUDGE) 02 December 1981, page 1 lines 66-69.	1, 2, 5-17, 19-29
Y	US 5,346,448 A (SOLLO) 13 September 1994, col. 6 lines 25-45.	1-5, 12-15, 17-23, 25-28
Y	US 5,306,220 A (KEARNEY) 26 April 1994, Fig. 3.	1-3, 5, 6, 15, 17, 19, 25-28
Y	US 4,205,838 A (MCINTOSH) 03 June 1980, Figs. 1 and 2.	16, 29



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents:	* T* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
* A* document defining the general state of the art which is not considered to be of particular relevance	* X* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
* B* earlier document published on or after the international filing date	* Y* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
* L* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	* A* document member of the same patent family
* O* document referring to an oral disclosure, use, exhibition or other means	
* P* document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search

07 APRIL 1999

Date of mailing of the international search report

05 MAY 1999

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/US99/02482

BOX II. OBSERVATIONS WHERE UNITY OF INVENTION WAS LACKING

This ISA found multiple inventions as follows:

This application contains claims directed to more than one species of the generic invention. These species are deemed to lack Unity of Invention because they are not so linked as to form a single inventive concept under PCT Rule 13.1. In order for more than one species to be searched, the appropriate additional search fees must be paid. The species are as follows: Species A, Figs. 1-7; Species B, Figs. 8-10; and Species C, Figs. 11 and 12.

The claims are deemed to correspond to the species listed above in the following manner:

Claims 1-29, Species A.

Claims 1, 3, 5-16 and 30-48, Species B.

Claims 1, 3, 5-16 and 30-46, Species C.

The following claims are generic: 1, 3 and 5-16.

The species listed above do not relate to a single inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, the species lack the same or corresponding special technical features for the following reasons: The species are distinguished by the means which they engage the bench.